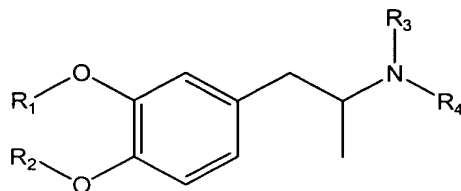


WHAT IS CLAIMED IS:

1. A compound of the formula:



Formula I

wherein: R<sup>1</sup> is H, lower alkyl, a protecting group, or is taken together with R<sup>2</sup> to form a ring,

R<sup>2</sup> is H, lower alkyl, a protecting group, -(CH<sub>2</sub>)<sub>n</sub>C(O)R<sup>6</sup> or -(CH<sub>2</sub>)<sub>n</sub>R<sup>6</sup> or is taken together with R<sup>1</sup> to form a ring,

R<sup>3</sup> and R<sup>4</sup> are independently H or lower alkyl or a protecting group, or, when R<sup>1</sup> is taken together with R<sup>2</sup> to form a ring, at least one of R<sup>3</sup> or R<sup>4</sup> is -(CH<sub>2</sub>)<sub>n</sub>C(O)R<sup>5</sup> or -(CH<sub>2</sub>)<sub>n</sub>R<sup>5</sup>, or when R<sup>1</sup> is not taken together with R<sup>2</sup> to form a ring, at least one of R<sup>1</sup> and R<sup>2</sup> is not H or lower alkyl or a protecting group,

R<sup>5</sup> is H, -OH, -SH, -O-lower alkyl, halogen, NH<sub>2</sub>, -succinimidyl, -maleimidyl, immunogenic carrier, or label,

R<sup>6</sup> is H, -OH, -SH, -O-lower alkyl, halogen, NH<sub>2</sub>, -succinimidyl, -maleimidyl, immunogenic carrier, or label, and

n is an integer from 1 to 5,

with the proviso that, when R<sup>1</sup> is CH<sub>3</sub>, R<sup>2</sup> is not -CH<sub>2</sub>C(O)R<sup>6</sup>, and

with the proviso that, when R<sup>1</sup> is taken together with R<sup>2</sup> to form a ring and when only one of R<sup>3</sup> and R<sup>4</sup> is H or lower alkyl and the other of R<sup>3</sup> and R<sup>4</sup> is -(CH<sub>2</sub>)<sub>n</sub>C(O)R<sup>5</sup>, R<sup>5</sup> is a protein,

and including acid salts thereof.

2. A compound according to Claim 1 wherein said immunogenic carrier is a poly(amino acid).

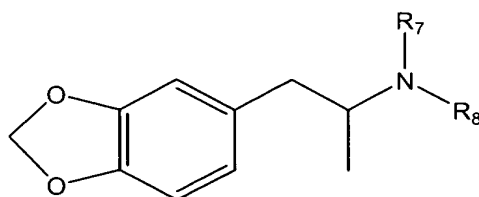
3. A compound according to Claim 2 wherein said poly(amino acid) is a protein.

4. Antibodies raised against the compound of Claim 3.

5. A compound according to Claim 1 wherein n is 1.

5 6. A compound according to Claim 1 wherein said label is an enzyme, a luminescer, or a radioisotope.

7. A compound of the formula:



Formula II

10

wherein:  $R^7$  is H, lower alkyl, a protecting group,  $-(CH_2)_nC(O)R^5$  or  $-(CH_2)_nR^5$ ,

$R^8$  is H, lower alkyl, a protecting group  $-(CH_2)_nC(O)R^5$  or  $-(CH_2)_nR^5$ ,

$R^5$  is H, -OH, -SH, -O-lower alkyl, halogen,  $NH_2$ , -NH-protein,

15 -succinimidyl, -maleimidyl, immunogenic carrier, or label, and

n is an integer from 1 to 5,

with the proviso that at least one of  $R^7$  and  $R^8$  are not H or lower alkyl, and

with the proviso that, when only one of  $R^7$  and  $R^8$  is H or lower alkyl and the other of  $R^7$  and  $R^8$  is  $-(CH_2)_nC(O)R^5$ ,  $R^5$  is a protein,

20 and including the acid salts thereof.

8. A compound according to Claim 7 wherein said protein is selected from the group consisting of KLH, BSA, BGG, and ovalbumin.

25 9. Antibodies raised against the compound of Claim 8.

10. A compound according to Claim 7 wherein n is 1.

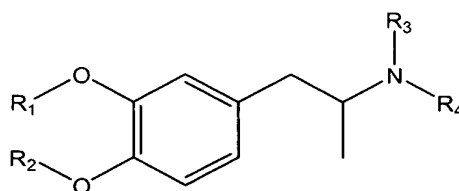
11. A compound according to Claim 6 wherein  $R^7$  is H or lower alkyl.

30

12. A compound according to Claim 7 wherein said label is an enzyme, a luminescer, or a radioisotope.

13. A method for determining a compound selected from the group  
5 consisting of 3,4-methylenedioxyamphetamine (MDA), 3,4-methylenedioxy-methamphetamine (MDMA), 3,4-methylenedioxyethylamphetamine (MDEA) and 4-hydroxy-3-methoxy-methamphetamine (HMMA), said method comprising:

- (a) providing in combination in a medium:
- (i) a sample suspected of containing said compound and
- 10 (ii) an antibody raised against a compound of the formula:

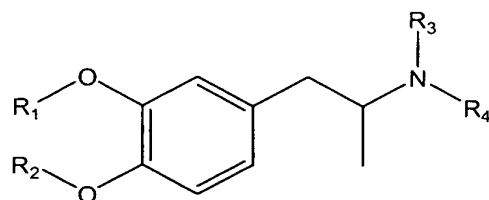


- wherein:  $R^1$  is H, lower alkyl or is taken together with  $R^2$  to form a ring,  
 $R^2$  is H, lower alkyl,  $-(CH_2)_nC(O)R^6$  or  $-(CH_2)_nR^6$ , or is taken together  
 15 with  $R^1$  to form a ring,  
 $R^3$  and  $R^4$  are independently H or lower alkyl, or, when  $R^1$  is taken together with  $R^2$  to form a ring, at least one of  $R^3$  or  $R^4$  is  $-(CH_2)_nC(O)R^5$  or  $-(CH_2)_nR^5$ , or when  $R^1$  is not taken together with  $R^2$  to form a ring, at least one of  $R^1$  and  $R^2$  is not H or lower alkyl,  
 20  $R^5$  is an immunogenic carrier,  
 $R^6$  is an immunogenic carrier, and  
 $n$  is an integer from 1 to 5, and

- (b) examining said medium for the presence a complex comprising said compound and said antibody, the presence thereof indicating the presence of said  
 25 compound in said sample.

14. A method according to Claim 13 wherein said combination further comprises:

- (iii) a label conjugate of the formula:



wherein:  $R^1$  is H, lower alkyl or is taken together with  $R^2$  to form a ring,  
 $R^2$  is H, lower alkyl,  $-(CH_2)_nC(O)R^6$  or  $-(CH_2)_nR^6$ , or is taken together  
 5 with  $R^1$  to form a ring,

$R^3$  and  $R^4$  are independently H or lower alkyl, or, when  $R^1$  is taken together with  $R^2$  to form a ring, at least one of  $R^3$  or  $R^4$  is  $-(CH_2)_nC(O)R^5$  or  $-(CH_2)_nR^5$ , or when  $R^1$  is not taken together with  $R^2$  to form a ring, at least one of  $R^1$  and  $R^2$  is not H or lower alkyl,

10  $R^5$  is a label,  
 $R^6$  is a label, and

$n$  is an integer from 1 to 5, and

said examining comprises measuring signal from said label, the amount thereof being related to the presence of said compound in said sample.

15

15. A method according to Claim 14 wherein said method is a homogeneous method and said medium is examined for the amount of said signal.

16. A method according to Claim 14 wherein said method is a heterogeneous  
 20 method and said complex, if present, is separated from said medium.

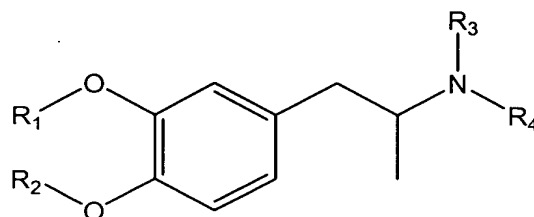
17. A method according to Claim 14 wherein said protein is selected from the group consisting of KLH, BSA, BGG and ovalbumin.

25 18. A method according to Claim 14 wherein  $n$  is 1.

19. A method according to Claim 15 wherein said label is an enzyme, a luminescer, or a radioisotope.

20. A kit for determining a compound selected from the group consisting of 3,4-methylenedioxyamphetamine (MDA), 3,4-methylenedioxy-methamphetamine (MDMA), 3,4-methylenedioxyethylamphetamine (MDEA) and 4-hydroxy-3-methoxymethamphetamine (HMMA), said kit comprising:

- 5 (a) an antibody raised against a compound of the formula:



wherein:  $R^1$  is H, lower alkyl or is taken together with  $R^2$  to form a ring,  
 $R^2$  is H, lower alkyl,  $-(CH_2)_nC(O)R^6$  or  $-(CH_2)_nR^6$ , or is taken together  
 10 with  $R^1$  to form a ring,

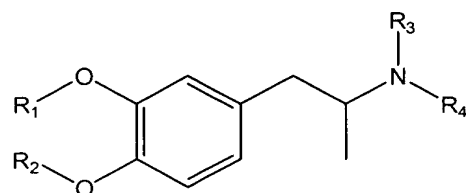
$R^3$  and  $R^4$  are independently H or lower alkyl, or, when  $R^1$  is taken together with  $R^2$  to form a ring, at least one of  $R^3$  or  $R^4$  is  $-(CH_2)_nC(O)R^5$  or  $-(CH_2)_nR^5$ , or when  $R^1$  is not taken together with  $R^2$  to form a ring, at least one of  $R^1$  and  $R^2$  is not H or lower alkyl,

- 15  $R^5$  is an immunogenic carrier,  
 $R^6$  is an immunogenic carrier, and  
 $n$  is an integer from 1 to 5, and

- (b) ancillary reagents for determining said compound.

20 21. A kit for determining a compound selected from the group consisting of 3,4-methylenedioxyamphetamine (MDA), 3,4-methylenedioxy-methamphetamine (MDMA), 3,4-methylenedioxyethylamphetamine (MDEA) and 4-hydroxy-3-methoxymethamphetamine (HMMA), said kit comprising:

- (a) an antibody for said compound,  
 25 (b) a label conjugate of the formula:



wherein:  $R^1$  is H, lower alkyl or is taken together with  $R^2$  to form a ring,  
 $R^2$  is H, lower alkyl,  $-(CH_2)_nC(O)R^6$  or  $-(CH_2)_nR^6$ , or is taken together  
 with  $R^1$  to form a ring,  
 5  $R^3$  and  $R^4$  are independently H or lower alkyl, or, when  $R^1$  is taken  
 together with  $R^2$  to form a ring, at least one of  $R^3$  or  $R^4$  is  $-(CH_2)_nC(O)R^5$  or  
 $-(CH_2)_nR^5$ , or when  $R^1$  is not taken together with  $R^2$  to form a ring, at least one  
 of  $R^1$  and  $R^2$  is not H or lower alkyl,  
 $R^5$  is a label,  
 10  $R^6$  is a label, and  
 $n$  is an integer from 1 to 5,  
 (c) ancillary reagents for determining said compound.

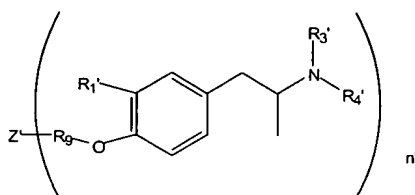
22. A kit according to Claim 20 wherein said protein is selected from the  
 15 group consisting of KLH, BSA, BGG and ovalbumin.

23. A kit according to Claim 20 wherein  $n$  is 1.

24. A kit according to Claim 21 wherein said label is an enzyme, a  
 20 luminescer, or a radioisotope.

25. A method for determining amphetamine and/or methamphetamine and/or  
 methylenedioxyamphetamine in a sample suspected of containing  
 methylenedioxyamphetamine and/or methylenedioxymethamphetamine and/or  
 25 methylenedioxyamphetamine, said method comprising:

- (a) providing in combination in a medium:
  - (i) said sample,
  - (ii) an antibody for methylenedioxyamphetamine, and/or
  - (iii) an antibody for methylenedioxymethamphetamine, and/or
  - 30 (iv) an antibody for methylenedioxyamphetamine, and
  - (v) a compound of the formula:



wherein:

$R^{1'}$  is H, or methyl or ethyl

$R^{3'}$  is H,

5  $R^{4'}$  is H, or methyl or ethyl,

$R^{9'}$  is  $-(CH_2)_nC(O)R^{6'}$  or  $-(CH_2)_nR^{6'}$ ,

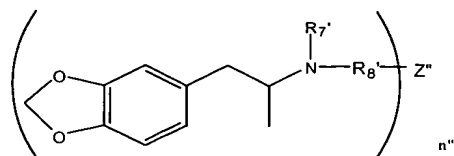
$R^{6'}$  is  $Z'$ , which is an enzyme,

$n'$  is an integer between 1 and the molecular weight of said enzyme divided by about 500; and

10 (b) examining said medium for the presence of a complex comprising said methylenedioxyamphetamine and said antibody for methylenedioxyamphetamine and/or a complex of said methylenedioxymethamphetamine and said antibody for methylenedioxymethamphetamine and/or a complex of said methylenedioxyethamphetamine and said antibody for methylenedioxyethamphetamine,  
15 the presence thereof indicating the presence of said methylenedioxyamphetamine and/or methylenedioxymethamphetamine and/or methylenedioxyethamphetamine in said sample.

26. A method for determining methylenedioxyamphetamine and/or  
20 methylenedioxymethamphetamine and/or methylenedioxyethamphetamine in a sample suspected of containing methylenedioxyamphetamine and/or methylenedioxymethamphetamine and/or methylenedioxyethamphetamine, said method comprising:

- (a) providing in combination in a medium:
- 25 (i) said sample,
- (ii) an antibody for methylenedioxyamphetamine, and/or
- (iii) an antibody for methylenedioxymethamphetamine, and/or
- (iv) an antibody for methylenedioxyethamphetamine, and
- (v) a compound of the formula:



wherein:

$R^{7'}$  is H, or methyl, or ethyl,

$R^{8'}$  is  $-(CH_2)_nC(O)R^{5'}$  or  $-(CH_2)_nR^{5'}$ ,

5  $R^{5'}$  is  $Z''$ , which is an enzyme,

$n''$  is an integer between 1 and the molecular weight of said enzyme divided by about 500; and

(b) examining said medium for the presence of a complex comprising said methylenedioxyamphetamine and said antibody for methylenedioxyamphetamine and/or  
 10 a complex of said methylenedioxymethamphetamine and said antibody for methylenedioxymethamphetamine and/or a complex of said methylenedioxyethamphetamine and said antibody for methylenedioxyethamphetamine, the presence thereof indicating the presence of said methylenedioxyamphetamine and/or methylenedioxymethamphetamine and/or methylenedioxymethamphetamine in said  
 15 sample.

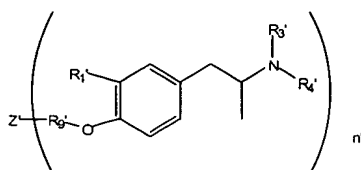
27. A method for determining methylenedioxyamphetamine and/or methylenedioxymethamphetamine and/or methylenedioxyethamphetamine in a sample suspected of containing methylenedioxyamphetamine and/or  
 20 methylenedioxymethamphetamine and/or methylenedioxyethamphetamine, said method comprising:

(a) providing in combination in a medium:

(i) said sample,

(ii) a conjugate of an enzyme and a methylenedioxyamphetamine  
 25 analog and/or a conjugate of an enzyme and a methylenedioxymethamphetamine analog and/or a conjugate of an enzyme and a methylenedioxyethamphetamine analog,

(iii) an antibody for methylenedioxyamphetamine, said antibody being raised against a compound of the formula:





wherein:

$R^{1'}$  is H, or methyl or ethyl

$R^{3'}$  is H,

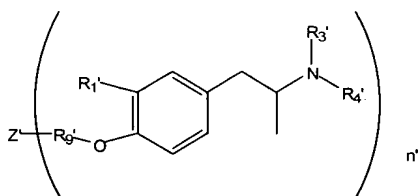
$R^{4'}$  is H,

5  $R^{9'}$  is  $-(CH_2)_nC(O)R^{6'}$  or  $-(CH_2)_nR^{6'}$ ,

$R^{6'}$  is  $Z'$ , which is an immunogenic protein or a non-poly(amino acid) immunogenic carrier,

$n'$  is an integer between 1 and the molecular weight of said immunogenic protein or said immunogenic carrier divided by about 500; and/or

10 (iv) an antibody for methylenedioxymethamphetamine, said antibody being raised against a compound of the formula:



wherein:

$R^{1'}$  is H, or methyl or ethyl

15  $R^{3'}$  is H,

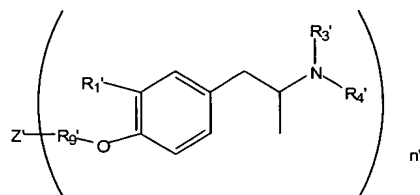
$R^{4'}$  is methyl,

$R^{9'}$  is  $-(CH_2)_nC(O)R^{6'}$  or  $-(CH_2)_nR^{6'}$ ,

$R^{6'}$  is  $Z'$ , which is an immunogenic protein or a non-poly(amino acid) immunogenic carrier,

20  $n'$  is an integer between 1 and the molecular weight of said immunogenic protein or said immunogenic carrier divided by about 500; and/or

(v) an antibody for methylenedioxyethamphetamine, said antibody being raised against a compound of the formula:



25 wherein:

$R^{1'}$  is H, or methyl or ethyl

$R^{3'}$  is H,

$R^{4'}$  is ethyl,

$R^{9'}$  is  $-(CH_2)_n C(O)R^{6'}$  or  $-(CH_2)_n R^{6'}$ ,

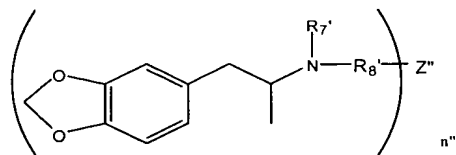
$R^{6'}$  is  $Z'$ , which is an immunogenic protein or a non-poly(amino acid) immunogenic carrier,

$n'$  is an integer between 1 and the molecular weight of said immunogenic protein or said immunogenic carrier divided by about 500; and

(b) examining said medium for the presence of a complex comprising said methylenedioxyamphetamine and said antibody for methylenedioxyamphetamine and/or a complex of said methylenedioxymethamphetamine and said antibody for methylenedioxymethamphetamine and/or a complex of said methylenedioxyethamphetamine and said antibody for methylenedioxyethamphetamine, the presence thereof indicating the presence of said methylenedioxyamphetamine and/or methylenedioxymethamphetamine and/or methylenedioxyethamphetamine in said sample.

28. A method for determining methylenedioxyamphetamine and/or methylenedioxymethamphetamine in a sample suspected of containing methylenedioxyamphetamine and/or methylenedioxymethamphetamine, said method comprising:

- (a) providing in combination in a medium:
- (i) said sample,
  - (ii) a conjugate of an enzyme and an methylenedioxyamphetamine analog and/or a conjugate of an enzyme and a methylenedioxymethamphetamine analog and/or a conjugate of an enzyme and a methylenedioxyethamphetamine analog,
  - (iii) an antibody for methylenedioxyamphetamine, said antibody being raised against a compound of the formula:



wherein:

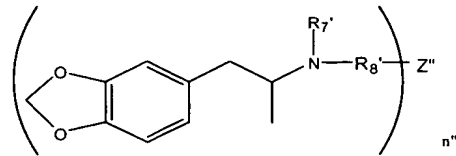
$R^{7'}$  is H,

$R^{8'}$  is  $-(CH_2)_n C(O)R^{5'}$  or  $-(CH_2)_n R^{5'}$ ,

$R^{5'}$  is  $Z''$ , which is an immunogenic protein or a non-poly(amino acid) immunogenic carrier,

$n''$  is an integer between 1 and the molecular weight of said immunogenic protein or said immunogenic carrier divided by about 500; and/or

- 5 (iv) an antibody for methylenedioxymethamphetamine, said antibody being raised against a compound of the formula:



wherein:

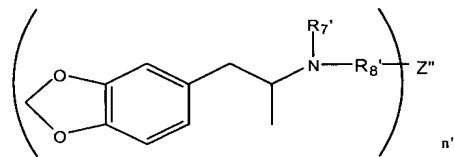
$R^{7'}$  is methyl,

10  $R^{8'}$  is  $-(CH_2)_n C(O)R^{5'}$  or  $-(CH_2)_n R^{5'}$ ,

$R^{5'}$  is  $Z''$ , which is an immunogenic protein or a non-poly(amino acid) immunogenic carrier,

$n''$  is an integer between 1 and the molecular weight of said immunogenic protein or said immunogenic carrier divided by about 500; and/or

- 15 (v) an antibody for methylenedioxyethamphetamine, said antibody being raised against a compound of the formula:



wherein:

$R^{7'}$  is ethyl,

20  $R^{8'}$  is  $-(CH_2)_n C(O)R^{5'}$  or  $-(CH_2)_n R^{5'}$ ,

$R^{5'}$  is  $Z''$ , which is an immunogenic protein or a non-poly(amino acid) immunogenic carrier,

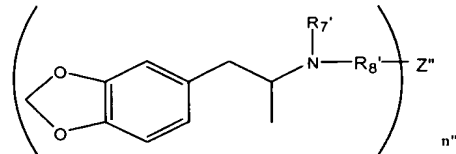
$n''$  is an integer between 1 and the molecular weight of said immunogenic protein or said immunogenic carrier divided by about 500; and

- 25 (b) examining said medium for the presence of a complex comprising said methylenedioxyamphetamine and said antibody for methylenedioxyamphetamine and/or a complex of said methylenedioxymethamphetamine and said antibody for methylenedioxymethamphetamine and/or a complex of said methylenedioxyethamphetamine and said antibody for methylenedioxyethamphetamine,

the presence thereof indicating the presence of said amphetamine and/or methamphetamine and/or methylenedioxyamphetamine in said sample.

29. A kit comprising in packaged combination:

- 5 (i) an antibody for methylenedioxyamphetamine, and/or  
 (ii) an antibody for methylenedioxymethamphetamine, and/or  
 (iii) an antibody for methylenedioxyamphetamine, and  
 (iv) a compound of the formula:



10 wherein:

$R^{7'}$  is H, or methyl, or ethyl,

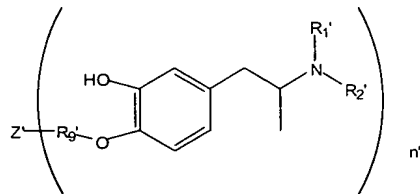
$R^{8'}$  is  $-(CH_2)_nC(O)R^{5'}$  or  $-(CH_2)_nR^{5'}$ ,

$R^{5'}$  is  $Z''$ , which is an enzyme,

15  $n$  is an integer between 1 and the molecular weight of said enzyme divided by about 500.

30. A kit comprising in packaged combination:

- (i) an antibody for methylenedioxyamphetamine,  
 (ii) an antibody for methylenedioxymethamphetamine, and/or  
 20 (iii) an antibody for methylenedioxyamphetamine, and  
 (iv) a compound of the formula:



wherein:

25  $R^{1'}$  is H,

$R^{2'}$  is H, or methyl or ethyl,

$R^{9'}$  is  $-(CH_2)_nC(O)R^{5'}$  or  $-(CH_2)_nR^{5'}$ ,

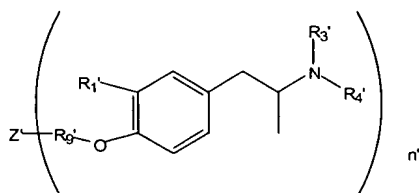
$R^{5'}$  is  $Z'$ , which is an immunogenic protein or a non-poly(amino acid) immunogenic carrier,

$n'$  is an integer between 1 and the molecular weight of said immunogenic protein or said immunogenic carrier divided by about 500.

31. A kit comprising in packaged combination:

5 (i) a conjugate of an enzyme and a methylenedioxyamphetamine analog and/or a conjugate of an enzyme and a methylenedioxymethamphetamine analog, and/or a conjugate of an enzyme and a methylenedioxyethamphetamine analog, and

10 (ii) an antibody for methylenedioxyamphetamine, said antibody being raised against a compound of the formula:

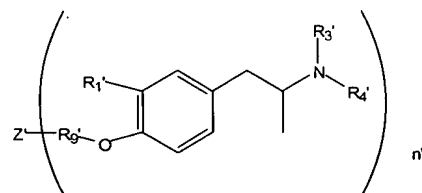


wherein:

$\text{R}^{1'}$  is H, or methyl or ethyl  
 15  $\text{R}^{3'}$  is H,  
 $\text{R}^{4'}$  is H,  
 $\text{R}^{9'}$  is  $-(\text{CH}_2)_n\text{C}(\text{O})\text{R}^{6'}$  or  $-(\text{CH}_2)_n\text{R}^{6'}$ ,  
 $\text{R}^{6'}$  is  $\text{Z}'$ , which is an immunogenic protein or a non-poly(amino acid) immunogenic carrier,

20  $n'$  is an integer between 1 and the molecular weight of said immunogenic protein or said immunogenic carrier divided by about 500; and/or

(iii) an antibody for methylenedioxymethamphetamine, said antibody being raised against a compound of the formula:



25 wherein:

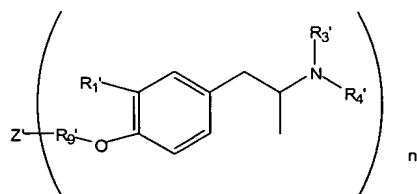
$\text{R}^{1'}$  is H, or methyl or ethyl  
 $\text{R}^{3'}$  is H,  
 $\text{R}^{4'}$  is methyl,

$R^{9'}$  is  $-(CH_2)_nC(O)R^{6'}$  or  $-(CH_2)_nR^{6'}$ ,

$R^{6'}$  is  $Z'$ , which is an immunogenic protein or a non-poly(amino acid) immunogenic carrier,

$n'$  is an integer between 1 and the molecular weight of said immunogenic protein or said immunogenic carrier divided by about 500, and/or

(iv) an antibody for methylenedioxyamphetamine, said antibody being raised against a compound of the formula:



wherein:

$R^{1'}$  is H, or methyl or ethyl

$R^{3'}$  is H,

$R^{4'}$  is ethyl,

$R^{9'}$  is  $-(CH_2)_nC(O)R^{6'}$  or  $-(CH_2)_nR^{6'}$ ,

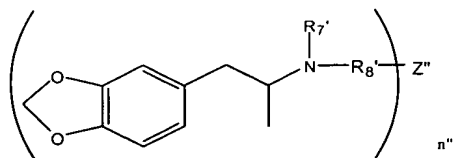
$R^{6'}$  is  $Z'$ , which is an immunogenic protein or a non-poly(amino acid) immunogenic carrier,

$n'$  is an integer between 1 and the molecular weight of said immunogenic protein or said immunogenic carrier divided by about 500.

32. A kit comprising in packaged combination:

(i) a conjugate of an enzyme and an methylenedioxyamphetamine analog and/or a conjugate of an enzyme and a methylenedioxymethamphetamine analog, and/or a conjugate of an enzyme and a methylenedioxyamphetamine analog, and

(ii) an antibody for methylenedioxyamphetamine, said antibody being raised against a compound of the formula:



wherein:

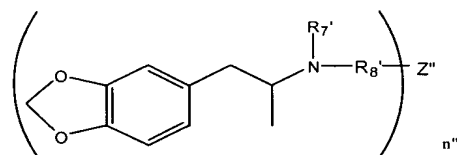
$R^{7'}$  is H,

$R^{8'}$  is  $-(CH_2)_nC(O)R^{5'}$  or  $-(CH_2)_nR^{5'}$ ,

$R^{5'}$  is  $Z''$ , which is an immunogenic protein or a non-poly(amino acid) immunogenic carrier,

5  $n''$  is an integer between 1 and the molecular weight of said immunogenic protein or said immunogenic carrier divided by about 500; and/or

(iii) an antibody for methylenedioxymethamphetamine, said antibody being raised against a compound of the formula:



10 wherein:

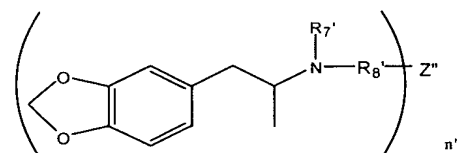
$R^{7'}$  is methyl,

$R^{8'}$  is  $-(CH_2)_nC(O)R^{5'}$  or  $-(CH_2)_nR^{5'}$ ,

$R^{5'}$  is  $Z''$ , which is an immunogenic protein or a non-poly(amino acid) immunogenic carrier,

15  $n''$  is an integer between 1 and the molecular weight of said immunogenic protein or said immunogenic carrier divided by about 500, and/or

(iv) an antibody for methylenedioxyethamphetamine, said antibody being raised against a compound of the formula:



20 wherein:

$R^{7'}$  is ethyl,

$R^{8'}$  is  $-(CH_2)_nC(O)R^{5'}$  or  $-(CH_2)_nR^{5'}$ ,

$R^{5'}$  is  $Z''$ , which is an immunogenic protein or a non-poly(amino acid) immunogenic carrier,

25  $n''$  is an integer between 1 and the molecular weight of said immunogenic protein or said immunogenic carrier divided by about 500.

\* \* \* \* \*